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研究簡報

Mechanical Transmission of Rice Transitory Yellowing Virus to a Non-gramineous Host Plant

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Rice transitory yellowing is a virus disease that occuɪs in Taiwan, in several provinces of South China (under the name of rice yellow stunt)[3,6], and in Japan[10,12]. The causal virus, a member of the plant rhabdovirus group, has been shown to be transmissible by three species of *Nephotettix* leafhopper, viz. *N. nigropictus* (Stol) (=*N. apicalis* Motsch.), *N. cincticeps* (Uhler), and *N. virescens* (Distant) (=*N. impicticeps* Ishihara[4,5,9]. Previous attempts to transmit it by mechanical means, through either seed or soil, failed[5]. According to Chiu *et al.*[4], the virus did not infect two different gramineous plants in a greenhouse test using *N. nigropictus* as vector. More recently, Chen[2] reported infection of *Leexsia hexandra* and *Panicum masimum* with RTYV. The virus was recovered by a small fraction of the test leafhoppers *N. cincticeps*. It has not been transmitted to any non-gramineous plants experimentally. In this report, we demonstrate the transmissibility of RTYV by mechanical means to *Nicotiana rustica* on which discrete, chlorotic local lesions were produced on inoculated leaves.

N. rustica was grown in 7.5cm plant pots. The test plants were inoculated when they had about 4-6 expanded leaves.

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Prior to inoculation the plants were kept in the dark for 24 hr. More erratic results were obtained by using plants that had received no darkening treatment.

To prepare virus inoculum, rice leaves with conspicuous symptoms were collected from the pot-grown plants that had previously been infected with RTYV from vector insects. The leaves were extracted in 5-10 volumes (w/v) of 0.1 M neutral phosphate buffer containing 0.5% 2-mercaptoethanol and used as inoculum either unclarified or after clarification by low speed centrifugation. Immediately before inoculation, leaves of *N. rustica* were lightly dusted with 400-mesh carborundum and the inoculum applied with fingers. Inoculated plants were kept in a greenhouse for symptom development. Mock-inoculated plants were similarly held as controls.

N. rustica responded to RTYV inoculation by producing minute, chlorotic local lesions in about 38-45 days. The lesions, diam. 1-1.5 mm, were sufficiently discrete to allow easy counting (Fig. 1). The usually long incubation period on this lesion host appeared to have presented a problem in that, by the time of lesion appearance, some inoculated leaves often developed a pale yellow color which would completely mask the chlorotic lesions that would have otherwise developed. Some inoculated leaves died before completion of the incubation period for symptoms. No lesions were produced on the control plants.

Individual plants differed widely in susceptibility and the lesion response was rather erratic. Great variations occurred between the plants as well as the leaf positions. Table 1 gives the average lesion

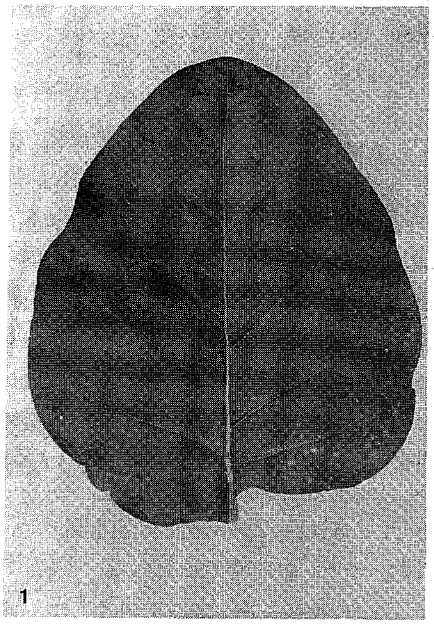

Fig. 1. Chlorotic lesions of RTYV on leaf of *Nicotiana rustica*. The right half-leaf received RTYV inoculation and the left half-leaf was mock-inoculated to serve as control.

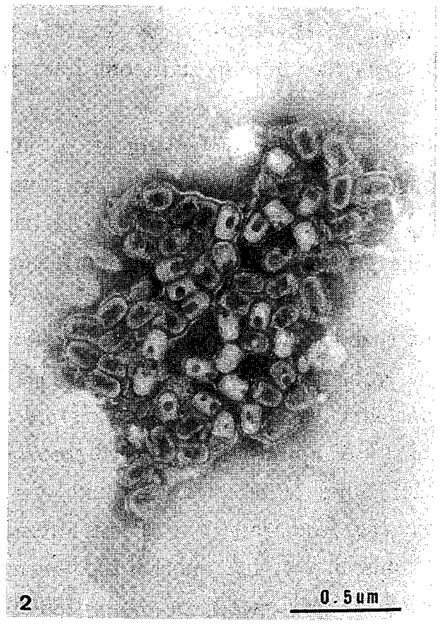

Fig. 2. Bullet-shaped particles of RTYV prepared in a leaf-dip from the lesion area and negatively stained with 2% phosphotungstic acid, pH 7.0.

Table 1. Number of RTYV lesions on *N. rustica* leaves as affected by leaf position

Experiment	Leaf position		
	Upper	Middle	Lower
1 *	34.3	10.0	5.1
2 *	25.0	7.9	4.5
3 **	610.7	336.2	160.7
4 **	491.9	305.1	152.5

* Using 32 plants, with one died before taking lesion counts.

** Using 16 plants.

numbers produced on three consecutive leaves suitable for inoculation.

RTYV was successfully passed from *N. rustica* to *N. rustica* up to four consecutive passages before it was accidentally lost. Infection of *N. rustica* plants with RTYV was established by two different lines of evidence: 1) Electron microscopic detection of the charcteristic bullet-shaped particles of RTYV[13] (Fig. 2) in sap preparations made from lesion areas, and 2) Injection of the vector leafhopper. *N. cincticeps* with leaf extracts resulting in the development of inoculativity of the injected insects. In two separate expriments, a toal of 70 insects were injected with diseased leaf extracts at various dilutions and 33 insects (47%) were rendered infective. No RTYV infectivity was detected in the 30 non-inoculated insects that served as control (Table 2).

Of nearly a dozen and a half different plant rhabdoviruses known to be transmitted by leafhoppers and planthoppers[7,8,11], only the potato yellow dwarf virus has been previously demonstrated to be mechanically transmissible[1]. RTYV appears to be a second case of successful transmission by mechanical means for the leafhopper-borne plant rhabdoviruses. This report also extends the host range of RTYV to non-gramineous plants.

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Table 2. Recovery of RTYV infectivity from *N. rustica* by injecting vector leafhoppers with leaf extracts

Experiment	Fraction of insects rendered infective for inoculum dilutions		
	1 : 100	1 : 500	Control
1	11/27	15/23	0/20
2	3/11	4/9	0/10

Viruses no. 35.

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水稻黃葉病毒之機械傳播至非禾本科寄主植物

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摘　　要

邱人璋、鐘美麗、陳慶忠、陳脉紀、謝式坢鈺、徐堯輝 1988 **水稻黃葉病毒之機械傳播至非禾本科寄主植物** 植保會刊 30：399—403.

水稻黃葉病毒(RTYV) 可藉機械傳播法自水稻傳至 *Nicotiana rustica* 植物上。受接種之葉片於接種後 38～45 天出現淡黃色約 1～1.5 mm 大小之病斑，自病斑組織製備之滴液標本，經陰染後在電子顯微鏡下觀察，可看到典型槍彈狀之 RTYV 顆粒；又將病葉汁液稀釋注射於黑尾浮塵子，部分（47%）受注射之媒介蟲隨後能將病毒傳於水稻。這些結果證明水稻黃葉病毒確可藉機械接種法，使 *N. rustica* 植物感染。迄今所知浮塵子或飛蝨類昆蟲傳播之植物 Rhabdoviruses（超過 15 種）中，可機械傳播者，旣知之例子僅 potato yellow dwarf virus 一種，本文所報告之 RTYV 爲第二個例子。由於 *N. rustica* 對 RTYV 之反應性，植株與植株間及不同葉位間之差異甚大，目前尚難利用於病毒感染力之測定。

（關鍵字：水稻病毒、水稻黃葉病、病毒之寄主、病毒傳播、*Nicotiana rustica*）

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